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ABSTRACT

This report offers a vision for digital learning and focuses on actions that schools, teachers, students, and parents must take to integrate digital content into the curriculum to create the learning environments that develop 21st century skills. Section 1 presents a vision for digital learning. The power of digital learning is discussed in Section 2, including the need for digital learning, the power and potential of digital learning, reasons why digital content is essential to digital learning, digital learning environments, digital learning develops 21st century skills, shifting to digital learning environments, models from the business community, readjustment (expanding the scope of technology integration), the critical importance of professional development, and integrating digital content. The following steps to integrate digital content effectively are presented in Section 3: (1) identify educational goals and link digital content to those objectives; (2) select the student outcomes and performance standards that will be achieved by digital content; and (3) measure and evaluate outcomes against standards and adjust accordingly. This section also includes two recommendations regarding digital content: perform a digital content inventory and increase investment in digital content. Section 4 presents a tool for self-assessment. Appendices include Year 3 statistics, "A Call for Equity," resources to help integrate digital content, ISTE (International Society for Technology in Education) and SCANS (Secretary of Labor's Commission on Achieving Necessary Skills) skills and standards. (Contains 30 references.) (MES)

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The CEO Forum

The Power of Digital Learning: Integrating Digital Content

IR020402

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The CEO Forum on Education and Technology

Founded in 1996, the CEO Forum on Education & Technology is a unique four-year partnership between business and education leaders who are committed to assessing and monitoring progress toward integrating technology in America's schools. The CEO Forum hopes to ensure that the nation's students will achieve higher academic standards and will be equipped with the skills they need to be contributing citizens and productive workers in the 21st century.

The CEO Forum Four Year Agenda

Year 1: *The School Technology and Readiness Report: From Pillars to Progress* (October 1997) The first report issued by the CEO Forum focused on the importance of integrating all the elements of education technology, from hardware and connectivity to professional development and content.

- STaR Chart, a self-assessment tool for schools to gauge progress toward integrating technology to improve education.
- STaR Assessment, a benchmark measure of national progress toward integrating technology in schools.

Year 2: *Professional Development: A Link to Better Learning* (February 1999) This second-year report focused on educator professional development, the foundation for effective use of technology in education.

- Ten Principles for Effective Professional Development
- STaR Chart Update
- STaR Assessment Update

Year 3: *The Power of Digital Learning: Integrating Digital Content* (June 2000) This report offers a vision for digital learning and focuses on the actions that schools, teachers, students and parents must take to integrate digital content into the curriculum to create the learning environments that develop 21st century skills.

- A Vision for Digital Learning
- STaR Chart Update
- Key Questions for Digital Learning

Year 4: The CEO Forum will release its final report, focused on educational outcomes and assessments, in Spring 2001.

Organizing Principles

- **All students must graduate with the technology skills needed in today's world and tomorrow's workplace.**
- **All educators must be equipped to use technology as a tool to achieve high academic standards.**
- **All parents and community members must stay informed of key education technology decisions confronting policy-makers, administrators and educators.**
- **All students must have equitable access to technology.**
- **The nation must invest in education technology research and development.**

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Letter from the CEO Forum

Technology has fundamentally changed the way we live and work. Now we need to apply technology's powerful tools to change the way our students, of every age, learn.

Since we published our last report, *Professional Development: A Link to Better Learning* in February 1999, and its companion *Teacher Preparation STaR Chart: A Self-Assessment Tool for Colleges of Education* in January 2000, schools and districts have continued to make remarkable progress acquiring hardware, establishing connectivity and ensuring that teachers receive technology training. However, as technology transforms the global digital economy, schools lag behind in the true integration of the vast resources technology makes available. While a majority of teachers now utilize technology to help perform administrative functions, only 33 percent of K-12 teachers say that they feel "very well prepared" or "well prepared" to integrate high-quality digital content into instruction.[1]

The CEO Forum planned to address each of the "Four Pillars" that the Clinton/Gore Administration defined in its vision for improving education through the use of technology in America's schools. These four pillars are 1) hardware; 2) connectivity; 3) software; and 4) professional development.[2] In year one, the CEO Forum tackled the issue of hardware and connectivity. In year two, the CEO Forum offered recommendations for effective professional development.

The CEO Forum originally intended to focus this report solely on digital content. However, as we explored the exciting opportunities for education in the digital age, we determined that addressing digital content separately would not help schools take full advantage of the tremendous resources offered by technology. The CEO Forum strongly believes that the key to creating the best possible educational environments in the 21st century is the seamless integration of technology, connectivity, content and people throughout the curriculum. We define this integrated approach as digital learning.

We urge schools to make the necessary commitments and adjustments to transform themselves into digital learning environments. This report provides:

- an overall vision for digital learning;
- a description of the power and potential of digital learning;
- a call to continue to make the necessary adjustments in processes, teaching and learning to ensure schools and districts implement digital learning,
- steps to ensure greater success in integrating digital content effectively; and
- recommendations we believe are critical regarding digital content.

We hope this report paints a compelling picture of the expansive possibilities created by digital learning. We also hope it provides practical guidelines and tools educators can put to work in their schools to realize the full benefits of the technology infrastructure now in place. And finally, we hope it prompts decisive action to ensure that digital content is integrated into instruction to promote the engaging digital learning environments that develop 21st century skills.

John Hendricks
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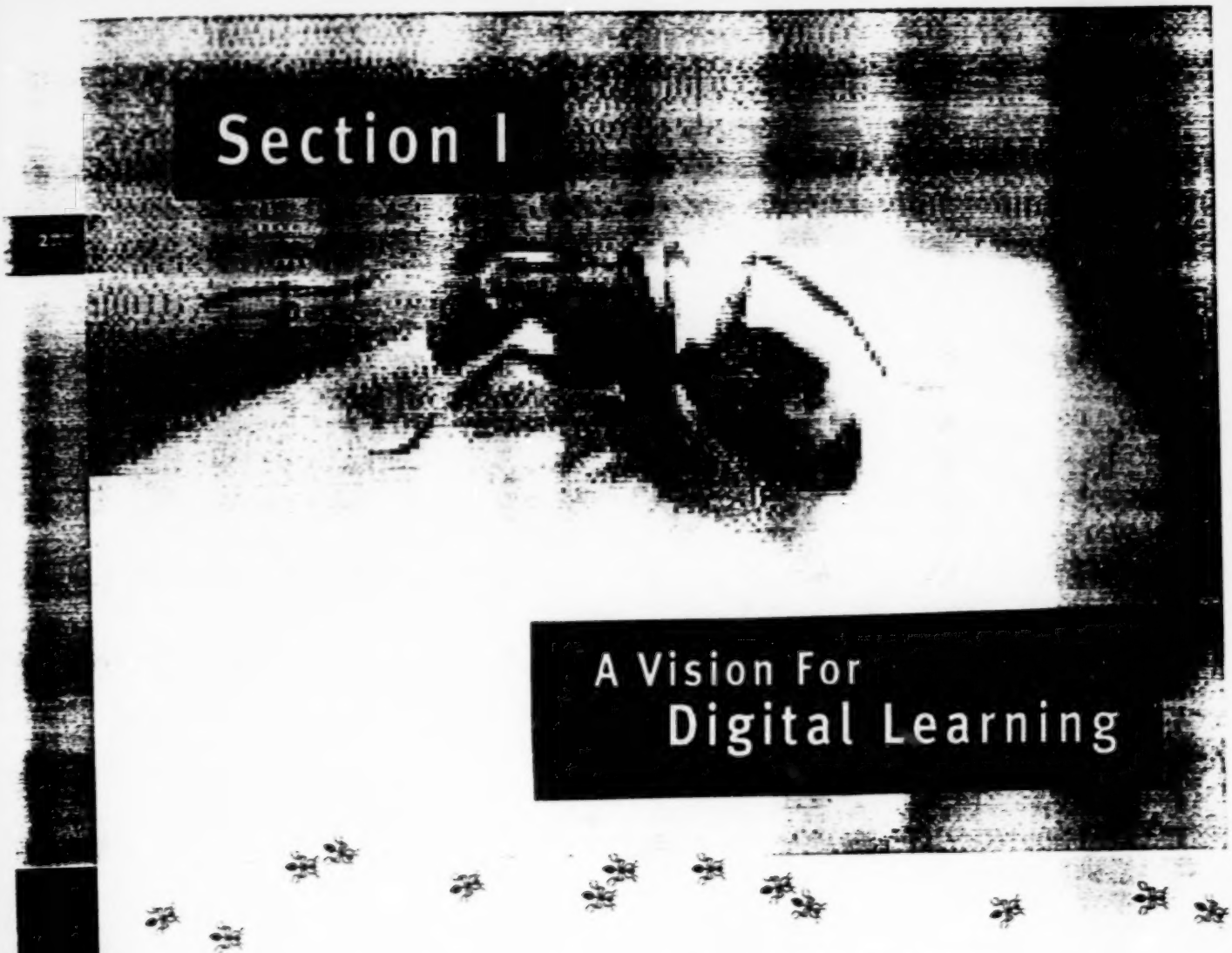

Section I

A Vision For Digital Learning

"Schools have made tremendous progress in bringing computers into the classroom and connecting to the Internet. There is an excellent opportunity for schools to integrate quality digital content into an exciting curriculum that challenges students to high standards—such as allowing chemistry students to see 3-D models of molecules or history students to access artifacts from the Civil War."

— United States Secretary of Education Richard W. Riley

Veteran teacher Ms. Perez-Drake opened her first week of classes in November with the usual topic—bugs—but her application of digital tools and content made this year's exploration of the insect world anything but ordinary.

With the help of the Internet, students embarked on a virtual field trip to a Natural History Museum three thousand miles away. After touring exhibits, students interviewed and questioned experts and curators via two-way video conferencing. As students broke into teams to study specific species, Ms. Perez-Drake guided and managed their individual research and learning plans.

One group of students narrowed their investigation to ants. Unlike the hundreds of Ms. Perez-Drake's students over the years who simply drew pictures to memorize ant anatomy, these students used an animation simulator. With this tool, the students created a three-dimensional moving ant model. When they forgot to include all the limbs, their creation hobbled jerkily. This humorously reinforced basic facts about movement and structure. In the field, members of the team carried hand-held personal digital assistants to record and send

"Technology facilitates students in explorations that can invigorate in-depth analytical thinking, inspire creativity, stimulate curiosity and develop skills of innovation. Our challenge is to integrate its reach into all curriculums and to deliver its global opportunities to all learners. Its beauty will be found in the powerful development of remarkable, authentic learning achievements, innovative demonstrated understanding of curricular content and intellectual vigor in lifelong learners."

—Florence McGinn, high school English teacher and Commissioner, Web-based Education Commission

"Technology allowed me to connect with people throughout the world. The people and information technology made available heightened my interest in politics and economics and gave me a deeper understanding of Latin America. Learning from others has been powerful and teaching others has shown me countless new possibilities."

—David Mericle, high school student, creator of a web site dedicated to Latin American history and culture, http://library.advanced.org/18355, and founder of a non-profit student exchange, www.seca.org.

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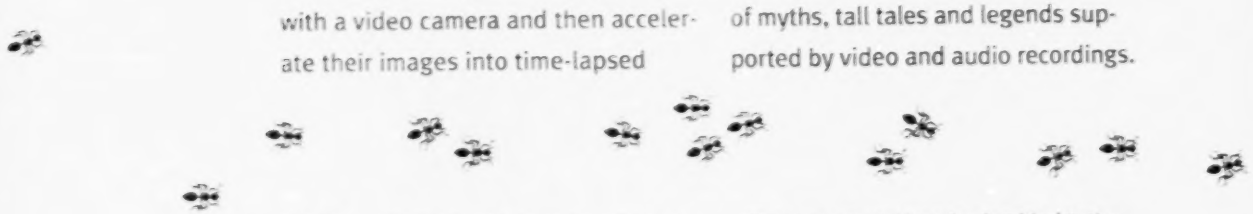
data regarding the population, habitat, soil quality and moisture levels instantaneously via their wireless connection to the Internet. The four collaborators back at school built and organized their findings into a database. This gave a baseline to compare and analyze their findings against those from other parts of the world. As the group searched for a more original way to report on the ants' activities, Ms. Perez-Drake helped them contact a camera operator from the local TV-station by e-mail. This expert gave the students tips on how to record a twenty-four hour period with a video camera and then accelerate their images into time-lapsed footage with video editing software.

The entire class voted to include this video clip and report on their insect web page and to share their profiles with students in China. E-mail correspondence with China turned up not only surprising information about the different kinds of red ants that live in China, but also the respect Chinese culture accords the cricket. As the students were preparing to delve into myths and legends, they elected to combine the two subjects. Ms. Perez-Drake coached the students on the creation of a site that profiled the different insects and included students' versions of myths, tall tales and legends supported by video and audio recordings.



"Digital learning can help us reach across the nation and tap into the vast educational resources this country offers. The dynamic learning environment created with new tools and digital resources will give hope and encouragement to our students so that all children can benefit from technology and achieve at the highest levels possible."

—Clarice Chambers, local school board member in Pennsylvania

"Shifting to digital learning is critical to the success of education in America. Not only does it allow for relevant, innovative approaches that open new worlds of learning, but it will ensure that today's children can be productive members of tomorrow's workforce."

—John Hendricks, Founder, Chairman and CEO Discovery Communications, Inc.

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Digital content and tools invigorate the same topic Ms. Perez-Drake's students have explored for decades in traditional textbooks, transforming the learning process in progressive new ways. This is fourth grade education in the 21st century.

Digital learning is the educational approach that integrates technology, connectivity, content and human resources. Creative, committed teachers like Ms. Perez-Drake embrace digital learning to help students achieve core educational objectives. These student-centered projects create innovative learning environments that encourage self-direction, investigation, collaboration and problem-solving. In addition to making the learning process more engaging, digital learning develops the skills students will need to succeed in the 21st century. Digital learning creates exciting new opportunities in education and also challenges the education community to develop new processes and methodologies for teaching and learning.

Building on the foregoing observations, the message of this report is quite simple: the CEO Forum encourages schools, school districts, business leaders, community members, teachers and parents to commit to the adjustments and changes necessary to provide every student with the advantages of digital learning.

"The biggest challenge is getting everyone to stop seeing technology as one more thing they need to add on, an adjunct rather than a part of the learning process. Technology is successful when it's used to make teaching and learning more constructive, more interactive – basically when it gives students broader horizons."

– Jeff Hornby, Technology Integration Specialist

"School boards are focusing a great deal of attention on technology and finding ways for administrators, teachers and students to make the best use of digital learning resources to improve student performance. If all children are to succeed in the 21st century, schools must take the right steps to create and sustain digital learning environments."

– Anne Bryant, executive director, National School Boards Association

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Section II

The Power of Digital Learning

The continued success and quality of American public education depends on our collective ability to close the gap between technology's mere presence and its effective integration into the curriculum to enhance student performance and deliver the skills necessary for the 21st century. The CEO Forum believes the solution begins with what we term digital learning.

The Need For Digital Learning

There is consensus among business leaders, educators, policymakers and parents that our current traditional practices are not delivering the skills our students will need to thrive in the 21st century. As part of our efforts at school reform, we should apply technology's[1] resources to develop the full academic abilities of all our students. The CEO Forum believes that only through the integrated approach of digital learning will our nation's schools, each operating under distinctive circumstances, opportunities and constraints, fully utilize technology in all its forms to promote student achievement and develop the essential skills.

We must make the necessary adjustments and shifts to ensure that our schools become digital learning environments. Adopting this integrated approach addresses the problems facing schools and can improve student performance. Today, a record 95 percent of schools and 72 percent of classrooms are connected to the Internet.[4] However, while 86 percent of teachers report using the Internet in teaching for e-mail and

The Power and Potential of Digital Learning

Digital learning is the educational approach that integrates technology, connectivity, content and human resources. When implemented correctly, it builds on the unique, dynamic characteristics of digital content to create productive and engaging learning environments.

Digital Content can be

- Randomly accessed
- Relevant, up-to-date and authentic
- Explored on many levels
- Interactive and engaging
- Manipulatable
- Instantaneous
- Creative

Learning becomes

- Problem and project centered
- Student centered
- Collaborative
- Customized
- Communicative
- Productive
- Lifelong at anytime, from anywhere

21st Century Skills

- Demonstrate technological literacy
- Communicate using variety of media
- Access and exchange information
- Compile, organize and synthesize
- Draw conclusions and make generalizations
- Know content and locate information
- Become self-directed learners
- Collaborate and cooperate in teams
- Interact in ethical ways

finding curricular materials,[3] only 66 percent of teachers use the Internet to enhance classroom instruction. Additionally, only 30 percent leverage the Internet for student research, only 27 percent use it to solve problems or analyze data and a meager 16 percent employ these tools for lesson planning.[4]

In short, we have placed so much focus on hardware, connectivity and rudimentary technology skills that our schools and students have not yet begun to realize the full potential of digital learning. We have also tended to discuss these components separately, when they must be seamlessly integrated to be most effective. Therefore, we must redouble our efforts to integrate digital content into the curriculum in order to ensure we apply these powerful tools in the creative ways that enhance student learning.

We recognize that our efforts to promote digital learning exist in an educational climate in which school systems and teachers are by necessity focusing on accountability structures. For both school systems and teachers this complicates the ability to implement digital learning. However, digital learning is critical if we are dedicated to preparing students with the necessary technology and critical thinking skills. We must extend accountability to the digital environment and link digital content and learning processes to student performance standards.

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Digital Learning: Students Access Resources Anytime, Anywhere

Dramatic results emerged in Hiawassee, a rural community in the North Georgia mountains, when every student and teacher received a wireless, networked laptop. The initiative included round-the-clock access to online curriculum content, teacher, student and family training, high-speed connectivity in school, dial-up access from home and reliable technical support. Not only have student test scores improved but the system has encouraged lifelong learners, enrollment in adult education classes has increased by 24%, and G.E.D. completions have risen by 71%.

For more information on one-to-one e-learning, visit www.netschools.net.

The Power and Potential of Digital Learning

Digital learning is the educational approach that integrates technology, connectivity, content and people. When implemented correctly, digital learning builds on the unique, dynamic characteristics of digital content to foster productive and engaging learning. This in turn both supports and promotes the essential skills students will need in education, life and work in tomorrow's world.

Digital Content is Essential to Digital Learning

When integrated effectively into the curriculum by skilled teachers, digital content enables students to seek and manipulate digital information in collaborative, creative and engaging ways that make digital learning possible. In a digital learning environment, just as in a traditional learning environment, content is anything used to teach or learn. It includes textbooks, films and worksheets but can also be a blueberry pie cut into pieces to illustrate fractions or baking soda and vinegar to explain the properties of a gas. Digital content is not just computer-based. It includes video on demand, software, CD-ROMs, web sites, e-mail, on-line learning management systems, computer simulations, streamed discussions, data files, databases and audio. When applied appropriately by teachers and students in a productive, project-centered learning environment, digital content makes a vast reservoir of information, ideas, resources and experts accessible at any time. The strength of the digital content in education stems from its dynamic characteristics that allow students to both locate and construct information. Digital content can be:

- **Randomly accessed.** The limitations of time, location, delivery and presentation no longer preclude students from accessing high-quality information. Information is transmitted, received, shared, organized and stored using a variety of delivery platforms and accessible through a range of devices.
- **Relevant, up-to-date and authentic.** Educators and students can augment curriculum with current, real-world information. This reality-based investigation encourages students to discover and understand real world implications.
- **Explored on many levels.** The dynamic nature of digital content allows teachers and students to explore subjects according to their needs, abilities and interests.
- **Interactive and engaging.** While traditional forms of content furnish information, digital content can stimulate and involve students.
- **Manipulatable.** Digital content can be evaluated, revised and produced, which allows students and teachers to apply information in increasingly complex ways.
- **Instantaneous.** With optimal bandwidth,

information becomes immediately accessible according to student and teacher needs.

- **Creative.** Digital content enables learners to be active participants in the learning process. Rather than passively accepting information, students can direct and choose their educational outcomes in new and sophisticated ways. The productive characteristics of digital content both inspire and allow greater creativity.

Digital Learning Environments

The creative use of digital content allows teachers and students to transform the learning environment into a more dynamic, demanding, vibrant and interactive exchange. These environments combine the best of traditional learning with the unprecedented opportunities created by technology. Once digital content is integrated into curriculum, the learning process becomes:

- **Problem and Project Centered.** Less concerned with one right answer, problem and project centered digital learning prepares students to answer questions and support arguments. When connected to real world information, students and teachers become more active in local and global community efforts.
- **Student-centered.** Students actively participate in defining their individual learning objectives and the plan to achieve them. Teachers take on the more sophisticated role of facilitators, while remaining the cornerstone of a student's learning team that also includes the student, parent, peers and outside experts. By providing the framework, goals, guidance and advice teachers help manage and encourage students as they pursue their own learning.
- **Collaborative.** Students engage in multi-age, interdisciplinary projects in teams within the school or at a distance. Learning becomes an interactive experience as teachers and students access content, exchange ideas and consult with experts at anytime from anywhere. As students pursue self-directed projects, teachers and students often exchange roles so that students teach their teacher.
- **Communicative.** Students, teachers and community members communicate and give feedback through e-mail, videoconferences, threaded discussions, bulletin boards, chat rooms, file transfer and even traditional and Internet-enabled voice telephony. Peer review exercises and local and global community efforts provide guidance, interaction and an increased sense of relevance and accountability. In addition, this interaction fosters a greater appreciation of various cultural perspectives.
- **Customized.** Digital learning conveys a new capacity for tailoring information to meet individual student needs, learning styles, and abilities. Tools such as student information systems and class management software can facilitate data-driven decision-making that

Digital Learning: Students are Engaged

In addition to reading the history in textbooks, students investigating the impact of droughts in sub-Saharan Africa develop current, relevant knowledge. They can:

- **employ digital geography and weather tools to examine the effects of a drought on local crops**
- **track patterns of rainfall**
- **simulate the effects of erosion with a software-modeling tool**
- **chronicle population shifts**
- **capture target information on random access video**
- **formulate and support hypotheses about effects on culture**
- **document their own conclusions about events**
- **produce stories about long-term ramifications**

21st Century Skills

The International Society for Technology in Education (ISTE) http://cnets.iste.org offers a new set of standards that should be mastered in digital learning environments in order to prepare students with the skills they will need in the 21st Century. The ISTE Standards are included in appendix D. Some of the skills developed by these standards are:

The ability to be proficient in the use of technology;

The ability to communicate information and ideas using a variety of media and formats;

The ability to access, exchange, compile, organize, analyze and synthesize information;

The ability to draw conclusions and make generalizations based on information gathered;

The ability to know content and be able to locate additional information as needed;

The ability to evaluate information and sources;

The ability to construct, produce and publish models, content and other creative works;

The ability to become self-directed learners;

The ability to collaborate and cooperate in team efforts;

The ability to solve problems and make informed decisions; and

The ability to interact with others in ethical and appropriate ways.

Digital Learning: Students become Content Producers

A group of students from Queens, NY created *Yo! It's Time For Braces* to inform and allay fears about orthodontic braces. On their web site they:

- gathered and offered advice, information and pictures from 20 orthodontists and other specialists
- interviewed an oral surgeon
- wrote a personal journal of one of the group's experience with braces
- designed an original cartoon story
- researched and described historical background
- provided personal hygiene product recommendations, recipes and links to related sites
- translated the survey and glossary into Russian
- encouraged children to write about their own experiences with braces

This site won a medal at the Thinkquest Junior Awards and became a health education finalist in the Global International Infrastructure Awards, along with the Mayo Clinic.
For more information visit, http://www.thinkquest.org

supports individual student needs. A greater range of content allows teachers to capture target information through random access video[7] and meld modules from various courses, so that learning becomes more dynamic and responsive.

- **Productive.** Innovative projects and digital tools encourage students and teachers to become content producers. Consequently, the quality of projects is elevated as students and teachers connect and receive feedback from the wider local and global community. Teachers and students also face an increased responsibility to be aware of and respect copyright and trademark laws in a digital environment.
- **Lifelong at anytime, from anywhere.** With wireless connections and distance learning, the artificial boundaries that often confine education fade in a digital environment. Students of every age and ability leverage communication technology, information resources, and people, close-by or at a distance.

Of the 54 jobs expected to experience the most significant growth between now and 2005, only eight do not require technological fluency. —U.S. Department of Labor

Digital Learning Develops 21st Century Skills

Not only does digital learning make education more engaging and relevant, but it also develops the skills necessary for students to succeed in life and eventually work. Digital learning does not change the fundamental purposes of education. However, in the rapidly evolving global digital economy, the shifting objectives of society and needs of students demand a corresponding adaptation of our education environments.[8] In the digital economy, technology dramatically alters the options for inquiry, analysis and expression. Today, the ability to find information quickly and efficiently, manipulate it and apply it to solve problems and inform decisions has become a primary asset.[9] The ability to learn, even for an organization, is a precursor to success.[10] Traditional educational environments and methods do not prepare students with the necessary skills to thrive in today's society, nor do they train them to prosper in tomorrow's workplace.[11]

For almost a decade, national attention has focused on a new set of skills necessary to prepare students for life and work in a world moving from the industrial age to the digital age. The necessary knowledge identified by the United States Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) includes five workplace competencies and a three-part foundation of skills and personal qualities necessary for solid job performance. These competencies are: the ability to use resources productively, master interpersonal skills, locate and manipulate information, understand systems thinking and operate technologies. According to SCANS, the foundation for these competencies rests with basic skills including reading, writing, and mathematics as well as the ability to think creatively, make decisions, solve problems and know how to learn.[12]

In the digital age, students will need to navigate technology's tools, which may mean knowing how to build HTML pages or being able to conduct a dialogue via two-way video conferencing, in order to take advantage of technology's opportunities. And, in a society, in which they will be barraged by digital images, students will need to develop multimedia literacy in order to understand the nuances of technology and form their own conclusions. Digital learning gives students a firm foundation in all these essential skills.

Shifting to Digital Learning Environments

The CEO Forum strongly believes that the integrated approach of digital learning is essential if we are dedicated to inspiring students to be lifelong learners and to preparing them for life and work. But in order to achieve digital learning, school districts and schools must increase their commitment and make the necessary readjustments to truly integrate digital content into the learning process.

Digital Learning: Teachers and Students Assume New Roles

Far from automating learning, when an art teacher embraced digital content for a multimedia collage project, the teacher assumed a more complex role. The teacher:

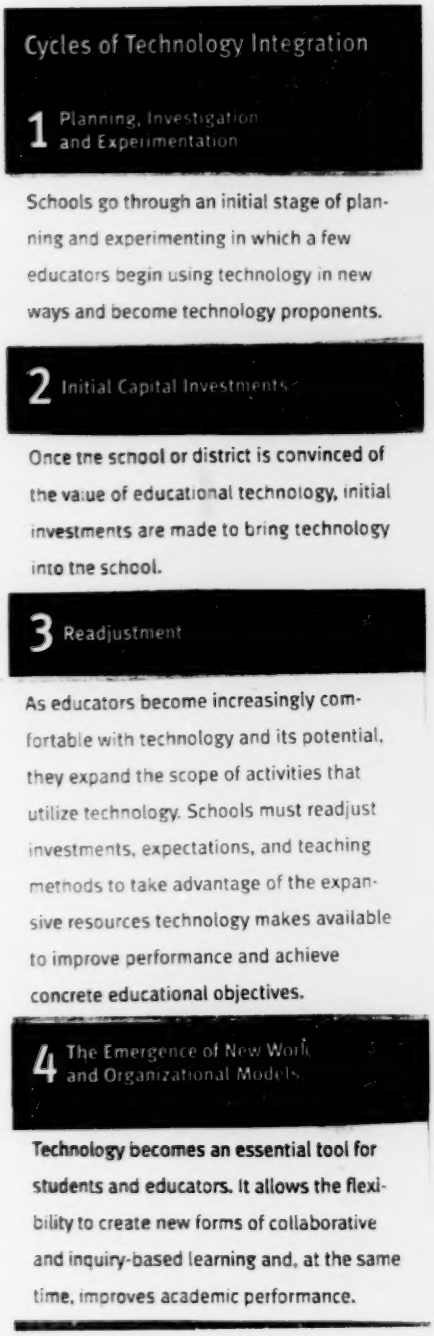
- corresponded with other art teachers to develop an engaging lesson plan, define research goals and test framework
- linked students to a digital library of museums and fine art collections all over the world
- assembled and facilitated a panel of curators and experts to be interviewed by students via two-way video
- coached students on exploring other avenues for research and on refining artistic techniques
- published student work and reviews on the school web site

Digital Learning: Students Develop Multimedia Literacy

In a Tacoma, Washington school's television studio, students collaborate to produce video segments. Students become the writers, producers, editors, directors, and set and graphic designers. Employing computers, digital cameras, video recorders and editing software, production teams create visual stories.

A team that produced a 20-minute segment on the local Humane Society learned hands-on lessons about building a compelling narrative and maintaining journalistic objectivity. When the segment was broadcast on the school system, students received valuable feedback from other teachers and peers. And, having created their own documentary, students now view media images more critically.

To learn more about Tacoma School District's video studio, call 253-571-1500.
For more information about desktop movies, visit http://apple.com/education


Cycles of Technology Integration
1 Planning, Investigation and Experimentation
Schools go through an initial stage of planning and experimenting in which a few educators begin using technology in new ways and become technology proponents.
2 Initial Capital Investments
Once the school or district is convinced of the value of educational technology, initial investments are made to bring technology into the school.
3 Readjustment
As educators become increasingly comfortable with technology and its potential, they expand the scope of activities that utilize technology. Schools must readjust investments, expectations, and teaching methods to take advantage of the expansive resources technology makes available to improve performance and achieve concrete educational objectives.
4 The Emergence of New Work and Organizational Models
Technology becomes an essential tool for students and educators. It allows the flexibility to create new forms of collaborative and inquiry-based learning and, at the same time, improves academic performance.

Models from the Business Community

As in corporate America, there are distinct cycles for the integration of technology into education. Corporate researchers have defined a four-stage cycle of technology integration,[15] which the CEO Forum recast to apply to the educational environment. As a result of our continued progress, most schools have reached the readjustment phase, a critical juncture when educators begin to expand the scope of activities in order to maximize the benefits of technology.

Readjustment: Expanding the Scope of Technology Integration

In this stage, schools must regularly adjust their investments, expectations and teaching methods to include the expansive resources technology makes available to improve student performance.

The CEO Forum urges schools to look closely at their organizational structures and processes to ensure that they are making the changes and adjustments necessary to support and promote digital learning. Schools may need to reexamine and reorganize their structures and incentives to ensure that their processes and teaching methods support their

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"One of the enduring difficulties about technology and education is that a lot of people think about the technology first and the education later" —Dr. Martha Stone Wiske, Education Technology Center, Harvard Graduate School of Education

educational goals and objectives. Our educational standards must be extended to the digital environment. And our schools and teachers must be empowered to expand the scope of technology in teaching and learning.

There are certain preconditions that must exist before a school can embrace digital learning. First, a school must have adequate technological infrastructure and must commit to the vision of digital learning. Next, the school and district must continue to offer professional development that supports the integration of digital content into the curriculum and must develop a comprehensive plan for integrating digital content.

Critical Importance of Professional Development

Professional development, the subject of the CEO Forum's year two report, remains a key issue to creating digital learning environments. Specifically, professional development that guides teachers on the effective integration of digital content and tools rather than just offering technical know-how proves particularly successful. Of teachers who received 11 or more hours of training on integrating digital content and tools in the previous year, 48 percent say they rely on software and the Internet to a "very great" or "moderate" extent. That is almost double the percentage of teachers who did not receive training on integrating digital content. "Schools and districts should ensure that their professional development truly supports their digital learning goals.

Integrating Digital Content

A crucial component to achieving digital learning will be increasing the integration of digital content to ensure that it is included in the curriculum and available in the classroom. When applied by skilled teachers with clear educational objectives, dynamic digital content allows the increased levels of exploration and inquiry that make digital learning possible. We believe Section Three: Integrating Digital Content will help guide schools toward the formation of a comprehensive digital content plan.

We cannot afford to be complacent. The CEO Forum urges schools, districts, parents, teachers, business leaders and the larger community to partner and make the necessary adaptations to ensure that our children receive the full benefits of educational technology.

Digital Learning: Teachers Target Activities to Student Needs

Teachers can create multiple pathways to the same information so students can access and assimilate knowledge in the way that works best for them. A student who learns best through visual stimulus might learn a math concept through a simulation while a student with strengths in reading comprehension might learn the same math concept through a series of word problems.

Section III

Integrating Digital Content

14

Digital Content

Digital content is the digitized multimedia material that calls upon students to seek and manipulate information in the collaborative, creative and engaging ways that make digital learning possible. It includes video on demand, software, CD-ROMs, web sites, e-mail, on-line learning management systems, computer simulations, streamed discussions, data files, databases and audio. Digital content is critical to digital learning because it can be:

- **Relevant, up to date and authentic**
- **Explored on many levels**
- **Manipulatable**
- **Instantaneous**
- **Creative**

In year one, the CEO Forum addressed the critical issue of hardware and connectivity. In year two, we offered recommendations for effective professional development that supports the integration of technology. But our national investment in education technology cannot stop with hardware, connections and professional development. Technology must be applied in ways that help students learn.[15]

The CEO Forum believes that to create the digital learning environments that develop 21st century skills, schools must integrate digital content into the curriculum to promote student learning.

Schools and school districts need to adopt strategies to recognize the breadth of digital content and to integrate digital content into the curriculum so that it is widely used and available in the classrooms. If used effectively, digital content creates unique opportunities to achieve educational objectives and produce the dynamic, learner-centered and productive learning environments that support the development of 21st century skills.

Initial research indicates that when correctly applied, technology can have a positive effect on student learning, particularly in honing higher order thinking skills. However, it is demonstrated to be less effective if the educational objectives or the educational outcome of the technology use are not clear.[16]

The CEO Forum believes that schools and districts will need an overarching plan that integrates digital content within the curriculum to support educational objectives and improve student performance.

Once schools and districts commit to the vision of digital learning, the CEO Forum offers three steps to help ensure greater success in integrating digital content.

Steps

1. **Identify Educational Goals and Link Digital Content to Those Objectives**
2. **Select the Student Outcomes and Performance Standards That Will Be Achieved by Digital Content**
3. **Measure and Evaluate Outcomes Against Standards and Adjust Accordingly**

Steps to Integrate Digital Content Effectively

1 Identify Educational Goals and Link Digital Content to those Objectives Digital content offers a powerful arsenal of tools to educators and students. However, technology is not a panacea and can only improve and increase learning when applied to meet specific educational goals and objectives. Schools need to examine their educational goals and determine which ones will be supported by digital content. Educational objectives that cross disciplines and incorporate visual, problem-solving and student-generated products increasingly lend themselves to digital content. Of course, educators have been meeting these goals with traditional content for generations. However, digital content can now be incorporated to make learning more engaging, enticing and empowering and to allow greater levels of inquiry and investigation. Schools will need to revisit their curriculum and integrate digital content and tools to realize educational objectives.

In order to integrate digital content, the CEO Forum offers two additional recommendations:

Recommendations

1. **Perform a Digital Content Inventory**
2. **Increase the Investment in Digital Content**

Digital content must be integrated in order to create engaging digital learning environments. But, the CEO Forum believes certain conditions must exist before this can occur. An institution must commit to a vision of digital learning and must have a sufficient technological infrastructure and the professional development and processes to support the use of digital content. Building on this foundation, the CEO Forum offers these steps to help schools integrate digital content in the ways that help students learn.

1 Digital content and tools open a whole new set of options and life choices to the students of migrant farmworker families. These students face almost insurmountable barriers to education: struggling with language difficulties, lacking models of successful academic achievement and—most critically—relocating frequently, enrolling in as many as six schools a year. A group of federally funded projects set an educational objective of reducing the almost 50 percent drop-out rate and ensuring that migrant students achieve high school graduation. In Project ESTRELLA, high school students based in the Rio Grande Valley and Winter Garden areas of Texas travel with laptops. Guidance counselors design a course schedule and students download lessons from an Internet server. Students sign-on at migrant housing sites, libraries, or migrant summer school locations. Project staff and teachers stay in touch with students on-line. Families commit to substantial involvement, which encourages parents to get to know teachers, to advocate for their children and to build support for students staying in school. As an additional outcome, the access to technology builds skills and offers options to family and siblings as well. Initial results have shown increased high school graduation. For more information visit www.estrella.org.

1 Distance learning enables every student to gain access to the highest-quality education and can potentially elevate our national education performance standards. Options for motivated and able students are no longer limited by geographical isolation or lack of resources in individual schools. Virtual high schools in Florida, Maryland and Concord, Massachusetts provide individualized instruction that overcomes scheduling conflicts and teacher shortages. Florida offers a comprehensive virtual high school curriculum, while Maryland's Virtual High School of Science and Mathematics extends a cutting-edge, collaborative science and math curriculum to existing schools. In the Maryland model, the consortium of schools benefit from research models and processes that would be too costly for any one school to incorporate, thereby substantially improving the quality of education and investigation for all. All of these efforts extend highly valued, high-quality resources to students who otherwise would not have access to them. Distance learning both enhances the quality of education and equalizes opportunity. For a closer look at these virtual schools, visit Florida Virtual High School: http://www.fhs.net; Maryland Virtual High School of Mathematics and Science: http://mvhs.mbhs.edu; and, Concord Consortium, Concord, MA: http://www.concord.org.

2 Select the Student Outcomes and Performance Standards that will be Achieved by Digital Content Every state determines its own educational standards and every school system is required to implement curriculum to accomplish those standards. These curriculum standards and guidelines apply to digital content as well. Without clear performance outcomes and standards, even the best educational goals will be difficult to measure and evaluate. Schools should scrutinize digital content to ensure they select content with demonstrated performance gains.

1 Digitized video, Internet resources, two-way video and audio, and electronic mail are all tapped to construct and develop a middle-school learning community in Baltimore. The key ingredient is an electronic template that enables teachers to create online learning modules. All the resources are indexed according to topic and correlate with state outcomes and national content standards. Four middle schools and four major partners work with the University of Maryland, Baltimore City Schools and the SCANS 2000 Center (Johns Hopkins) to share ideas and materials. Maryland Electronic Learning Community (MELC) is a true learning community. There is no centralized source of expertise—learning reaches in all directions, to and from every participant. For an inside look at the MELC, visit www.learn.umd.edu.

1 There is a large number of corporate, government and foundation grant-sponsored sites that provide assistance with the daunting task of linking digital tools to the curriculum. A list of some of these resources is included in Appendix C.

2 The Kit & Kaboodle elementary science curriculum boosts scores. This innovative science curriculum poses authentic scientific problems to third, fourth and fifth grade students and provides opportunities to investigate solutions alongside real world researchers. Students participate in exciting expeditions such as touring space stations and discovering the world of Antarctic penguins. Teachers who used Kit & Kaboodle as their daily science lesson saw a 10 percent gain in test scores. Teachers who used the lessons sporadically received a more modest 4.5 percent gain. The lessons are closely tied to state and national curriculum requirements at each grade level. For more information, visit http://www.kitkaboodle.org.

2 Increasing numbers of students experience difficulty learning to read. Studies show that 38 percent of fourth graders do not attain even a basic level.[v] An in-depth assessment of technology-based reading programs identified those that successfully improved reading skills.[vi] One program highlighted was the Little Planet series. Little Planet is a research-based literacy program for K-3 classrooms that integrates technology and literacy. The series uses animated video stories, combined with computer software and instructional techniques, to develop reading and writing skills. Students participate in individual, small group and class exercises, and get the chance to be authors themselves. As students progress through the program, Little Planet analyzes performance and tailors reading activities to meet their needs, for example, giving visual learners more visually stimulating exercises. What Little Planet does most effectively is boost reading comprehension, a particularly difficult area to target improvement. Not only is Little Planet successfully teaching children how to read, it also offers early intervention to some children incorrectly identified as learning disabled. To learn more about this reading program, visit http://www.littleplanet.com.

3 Measure and Evaluate Outcomes against Standards and Adjust Accordingly Once schools have integrated digital content into the curriculum, they should expect to measure and evaluate outcomes and to make adjustments, just as they would with non-digital material and techniques. Schools need to utilize clear standards, benchmarking and regular data-driven evaluations of educational improvements to evaluate performance and target areas for improvement and readjustment.

3 When Virginia determined it was not achieving the desired student outcomes after a $200 million investment in education technology, policymakers suspended all funding in 1998 to perform a study to understand why. Virginia found that it had installed the necessary hardware, met connectivity goals, and even developed the necessary basic technology literacy skills in teachers and students. However, the technology was not being used to improve student learning. The curriculum had not been adjusted to integrate digital content in ways that inspired more creative, authentic and engaging teaching and learning. After this analysis, Virginia redirected its educational goals and created clear standards and outcomes. While Virginia seeks to make teachers and students more sophisticated users of technology, Virginia's educators are no longer using technology for technology's sake. Quantifiable results of this new direction are not yet available. Virginia now has clear standards to employ technology to meet the core mission of its schools: the achieving of learning and mastery of academic subject matter and skills. To learn more about Virginia's technology efforts, visit http://www.pen.k12.va.us.

3 West Virginia invested in a comprehensive longitudinal study to determine the effectiveness of a 10-year basic technology skills effort. As a result, West Virginia developed an integrated approach to employ the Internet to improve student instruction. A team of 48 teachers from a diverse regional and demographic cross-section of the state are partnering with a team from the West Virginia Department of Education to develop curricula in math, science, language arts and social studies. Teams ensure that each lesson meets the West Virginia Instructional Goals and Objectives and the West Virginia Process Workplace Objectives. Juries strictly evaluate lessons against these goals and standards, and only jury-approved lessons can be field tested and piloted. The goal is not only to create a comprehensive body of instruction but also to develop an effective methodology for integrating the Internet into instruction. The results are powerful. The BS/CE technology program that West Virginia used for 10 years yielded an 11 percent gain in standardized test scores for math, reading and language. Additionally, West Virginia's ranking in educational achievement moved from 33rd to 17th best, compared to all other states.[9] For more information about West Virginia's longitudinal study and juried curricula, visit http://reinvent.k12.wv.us.

3 Districts are also examining and evaluating the outcomes of their investments in technology. Miami-Dade County, an enormous urban system, invested over $40 million in educational technology during the 1998–99 school year. To determine whether these efforts are working, the Miami-Dade County Public Schools and a consortium of partners—including the North Central Regional Educational Laboratory and the Florida Educational Technology Corporation—commissioned a comprehensive study. Although results are not yet available, Miami-Dade has now published an impressive set of goals and standards. Dade County also provides an Internet toolkit to support teachers who want to use the Internet in their instructional activities. For information about Dade County's technology initiatives, visit http://dcps.dade.k12.fl.us.

3 The evaluation of our national investment in educational technology is an evolving process. The fourth CEO Forum report will focus on outcomes and assessments of our national education technology efforts. We will search to answer what positive educational outcomes can be driven and enabled by technology; what the leading indicators and measures of those effects are; and how we can administer these measures and make decisions and modifications accordingly. This report will be published in Spring 2001.

Key Recommendations Regarding Digital Content

The CEO Forum offers two recommendations to help ensure greater success after schools and districts commit to the vision of digital learning and take the initial steps to achieving it by linking digital content to educational objectives, selecting performance standards and measuring and evaluating against those standards.

1 Recommendation: Perform a Digital Content Inventory

In order to identify ways to meet educational goals more effectively and creatively, schools should examine the sources and purposes for content. Creating a detailed, cross-referenced catalog that recognizes the uses of digital content will identify curricular synergies and highlight gaps where the investment in or use of digital content should be increased. This does not mean schools and teachers should count the number of digital materials; rather, schools need to identify the existing digital content and ensure that everyone knows how to find and take advantage of this material. Therefore, this inventory should identify the sources and purposes of content, be indexed by subject, grade and inter-disciplinary applications, and should state the educational objectives and student performance standards that this content achieves. This should not be isolated to off-the-shelf video, software and CD-ROM packages, but should also recognize the dynamic, interactive and freely available web resources that can be integrated into the curriculum. This inventory will also become the basis for decisions about adding to the digital content resource base. Digital content is available in many forms and can be applied to meet various goals. These descriptions of the types of digital content, communications and tools highlight the flexibility of digital content. Organizing content into its various forms and then indexing that content by subject, grade and standard is a critical step to performing a digital content inventory.

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Different Types of Digital Content

Content

Student Instructional Content

Primary Sources
- Multimedia clips
- Streamed video
- Museum collections
- Library collections
- Diaries
- Letters
- Government records
- Speeches, etc.

Secondary sources
- Textbooks
- Reference works
- Data files
- Periodicals
- Three Dimensional Maps
- Databases

Teacher Preparation Materials

Units or lessons
Projects
Tutorials
Activities
Professional Training Modules

Student Products

Desktop movies
Projects
Art
Music
Drama
Collaborations

Special Interest

Contests
Games
Themes
Special Occasion
Awards

Digital Content: A Snapshot

While a great deal of digital content exists typically, most of it is either:

- primarily developed, presented and delivered by a company in a variety of formats, or
- free on the Internet, created by many different providers (including libraries, museums, non-profits, corporate partnerships, teachers, etc.), and requiring significant time and organization for teachers to make effective use of it.

Tools

Word Processing
Presentation
Web Page Designers
Calendars
Spreadsheets
Card Makers
Drawing
Layout and Design
Calculators
Search Engines
Lesson Maker
Project Sharing
Geographical Information Systems
Digital Cameras
Personal Digital Assistants

Communications

E-mail
Chat rooms
Bulletin Boards
Two-way video Conferencing
Synchronous discussion
Web casts
Streaming media
Threaded discussions

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2 Recommendation: Increase Investment in Digital Content

We must increase the access to high quality digital content to ensure that it is integrated into the curriculum. The CEO Forum strongly believes that 100 percent of instructional materials budgets should be available to purchase the most appropriate content to meet educational objectives. To achieve digital learning, school systems must examine their purchases of content and the human resources required to evaluate and effectively integrate digital content into the curriculum.

The United States spends $6.8 billion annually on instructional materials[29] for 50 million students. Overall, 30 percent, or $2 billion, of current curriculum materials budgets are spent on textbooks.[30] However, the remaining 70 percent is not all being spent on digital content. In many cases, this number becomes a catch-all for miscellaneous expenditures, including supplies, films, maps and records. It is also often used to purchase materials provided through grant funding rather than textbook dollar allocations. School systems will better meet their own educational outcomes by examining the financial model for all of technology—hardware, connectivity, professional development and digital content—in order to achieve the vision of digital learning.

Student learning is enhanced by digital content when it is applied in innovative ways to meet clear educational objectives. Although there is a great deal of interest in using digital content, teachers report difficulties finding enough time to identify appropriate sources of digital content to fit their needs.[31] Additionally, concerns about quality of digital content[32] and uncertainty about how to integrate digital content into instruction[33] deter teachers from transforming their classrooms into digital learning environments.

To make the vast digital content resources more readily available in the classroom, many schools, districts, companies and organizations have created digital toolkits, which link teachers to other sites and resources and lessons and connect those immediately to the standards and student outcomes these projects support. The CEO Forum has included a partial list of some of these many sites and resources in Appendix C.

The effective integration of digital content into curriculum requires investment and shared responsibility among all of the stakeholders to provide more and better digital content. The respective stakeholders should consider the following actions:

1 School systems should be examining whether they should purchase more digital content rather than generally expecting most of it to be free. We cannot expect that teachers will synthesize the freely available digital content and individually recreate all of the work that textbook companies have traditionally done to develop full-blown curriculum units, goals, activities and assess-

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The CEO Forum strongly believes that 100 percent of instructional materials budgets should be available to purchase the most appropriate content to meet educational objectives.

ment. While incorporating the ingenuity and creativity of individual teachers, schools and school systems must also procure organized digital content that supports their curriculum guidelines and standards. Additionally, schools and school systems should purchase up-to-date digital content that can be applied on a variety of platforms.

2 Companies that produce content must collaborate more with teachers and school systems to build and modify existing product that incorporates the creativity of teachers and the assessment of what works for students and is appropriate for different learning levels. The educational community must push the content industry harder to provide high-quality materials.

3 Companies that produce content should strive to have all content available in digital formats when appropriate, so that it can be directly accessed and manipulated by teachers and students.

4 States and school systems must provide the human resource of curriculum specialists and/or teachers to evaluate and integrate digital content into the curriculum. State and school systems must also facilitate the investment of professional development funds. When schools produce content, whether alone or in partnership with profit or non-profit entities, schools should work to make this content and any accompanying best practices in teaching and learning broadly available and shared within districts, states and the global and local community.

5 Government should continue to digitize and make available the vast lode of public domain information that is valuable to students, researchers and all citizens. Actions that capitalize on the numerous government-funded research programs that have produced quality content could help disseminate both the materials and information about the materials more effectively. Government should also examine and define copyright issues and appropriate parameters for manipulation in the digital environment. In some cases, commercial adaptation or distribution of the materials will speed the materials to schools.

6 Business, community members and parents must support educators and students in the quest for digital learning by educating the public on the crucial nature of digital content as the basis for a 21st Century education. We must all reevaluate entrenched notions that textbooks are the only legitimate source of instructional content.

Digital learning offers great power and potential for education. Therefore, in order to increase the return on our national investment in education technology, we must go further than computers, connectivity and professional development. We must take the final steps to ensure that our schools become true digital learning environments by investing adequately in digital content.

Innovative Approaches to Content Allocation

Many school systems are taking innovative approaches to their content funds allocation. In 1990, Texas, after determining that traditional forms of content were not meeting all of the educational objectives, made a groundbreaking decision to open textbook budgets to digital content. In 1998-99, only 9 percent of the total instructional materials budget was spent on textbooks.[4] Across the country, many small school systems concerned about meeting performance standards are making significant increases in their purchase of digital content. Some, such as Union County, TN are allocating 100 percent of their current instructional materials budgets to digital content.[5]

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Section IV

A Tool for Self Assessment: Key Questions for Digital Learning

Developing a Digital Learning Environment

The CEO Forum offers these questions to help schools and districts assess their progress and highlight areas for improvement in integrating digital content and developing digital learning environments.

Identifying Educational Goals

1. Has your school or community defined a set of 21st century skills that includes technological know-how, information literacy and problem solving, communication and collaboration expertise?
2. Are your educational goals aligned with other schools in your community and district?

Linking Digital Content to Educational Goals

1. Has your school identified the educational goals that will be met by digital content?
2. Is there a system to help teachers find, evaluate and test digital content and link that content to the curriculum?
3. Do teachers have the authority and time to test and implement new teaching tools and practices?
4. Are class times long enough to foster in-depth, collaborative projects?
5. How are students expected to obtain information, i.e., from textbooks, Internet, video, software?
6. Are the digital tools you expect teachers and students to employ readily accessible? Tools might include word processing, spreadsheets, databases, presentation programs, web design tools and image manipulation applications.
7. Do you encourage students and teachers to communicate and collaborate with peers in school and outside of school?
8. Do projects call upon students to become content producers?

Selecting Student Outcomes and Performance Standards

1. Have state and local curriculum guidelines and standards been translated to a digital learning environment?
2. Have you selected digital content with proven success in creating your desired student outcomes?
3. Does your school or district have a policy for communicating the benefits of digital content to parents?

Measuring and Evaluating Outcomes Against Standards

1. Have state and local assessments been translated to a digital learning environment?
2. How does your school or district measure and evaluate student information literacy?
3. What measurements will be used to gauge the effectiveness of digital content and learning in meeting your educational goals and standards?
4. In addition to traditional academic standards, are students evaluated on skills such as critical thinking, communication and collaborative abilities?
5. Does your school have mechanisms to adjust plans and budgets according to progress and outcomes?

Performing a Digital Content Inventory

1. Does your school have a central inventory of all digital content?
2. Is this inventory cross-referenced by discipline, grade and standard?

Increasing Investment in Digital Content

1. Do your district technology and instructional materials plans include the integration of digital content?
2. Have you shifted the allocation of instructional materials funds to incorporate content that better achieves your educational goals?
3. Can you reduce the purchase cost of the next cycle of textbooks to make more funds available for digital content?
4. Have you assigned the human resources and curriculum development expertise to integrate the otherwise free Internet digital content into instruction?

Other Important Issues to Consider

1. Does your school or district have a position on the issues of commercialization and advertising in a digital world?
2. Does your school or district have policies concerning the use of intellectual property and copyright in a digital environment?

Appendix A: Year 3 Snapshots

Hardware

Educators require the essential tools to enhance learning in the 21st century. Providing adequate hardware creates the basic infrastructure necessary in order to build a digital learning environment.

Statistics Update: Progress on the Four Pillars

In 1996, President Clinton articulated four pillars of education technology as part of his Technology Literacy Challenge:

1) hardware;

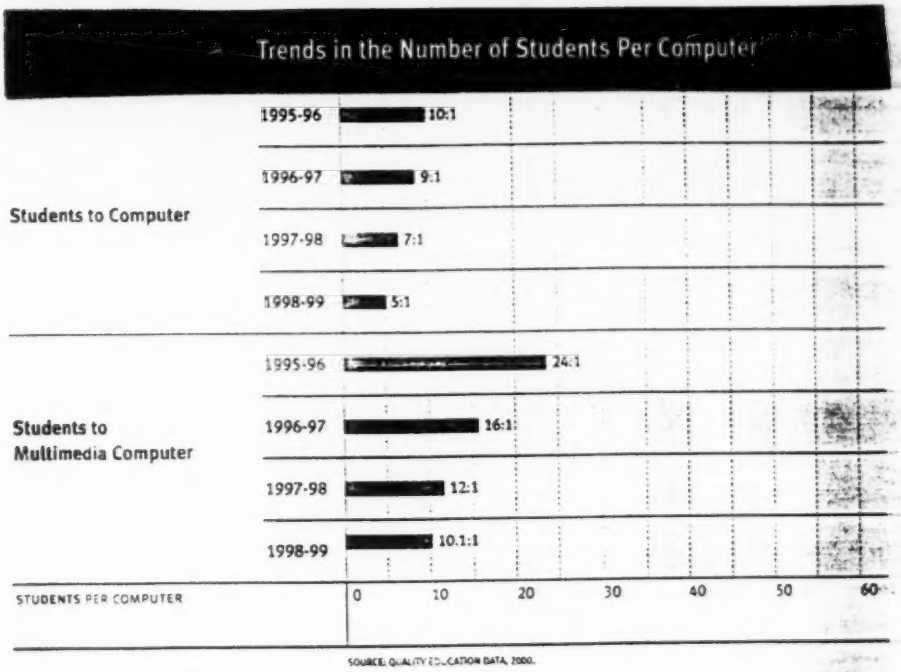
2) connectivity;

3) software; and

4) professional development.

Digital learning builds on the foundation of these four pillars to create innovative educational environments for life and work in the digital world.

The CEO Forum believes hardware, connectivity, content and professional development must be integrated in order to create digital learning environments. This appendix presents a snapshot of our progress on each of the four pillars.



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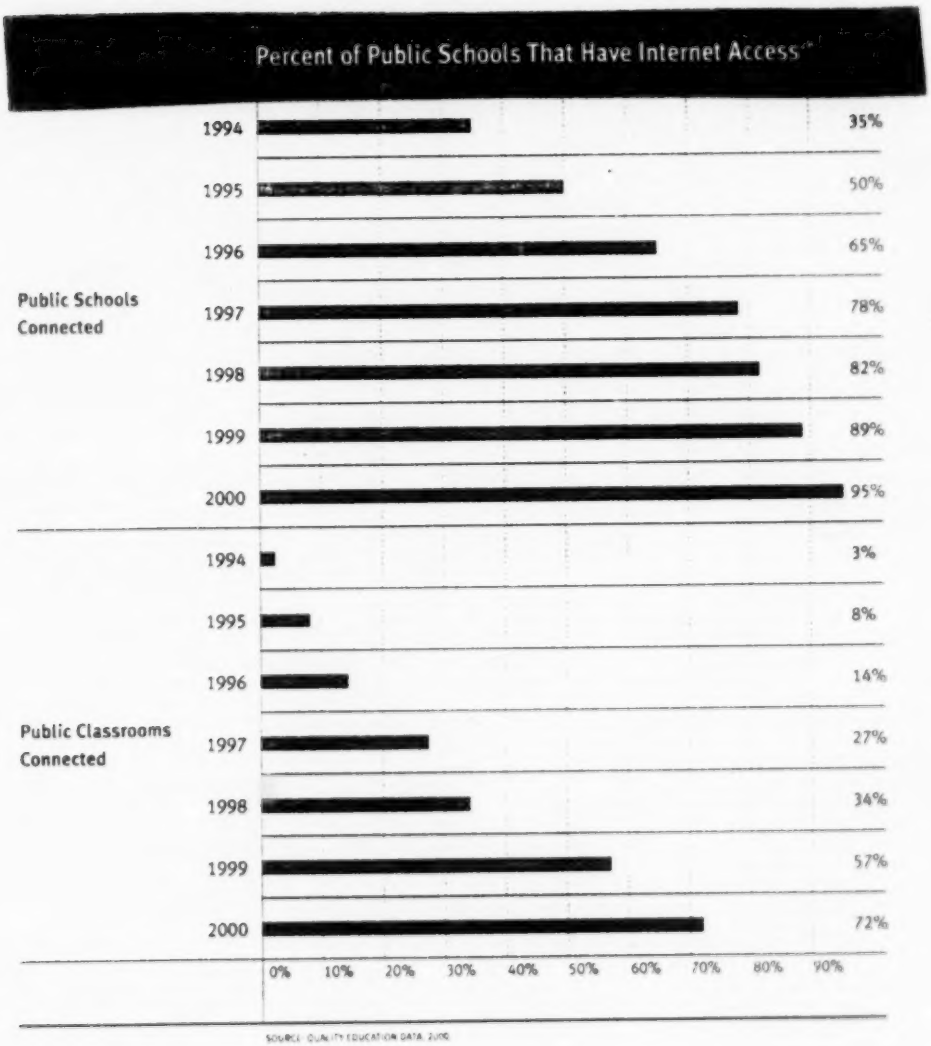
Connectivity

The combination of hardware and networks opens an unprecedented level of communication and collaboration and links students to vast reservoirs of information and experts.

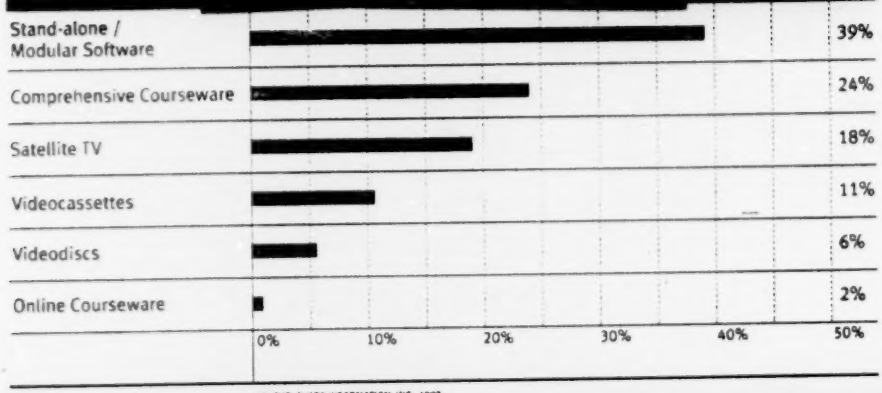


SOURCE: QUALITY EDUCATION DATA, 2000

Content

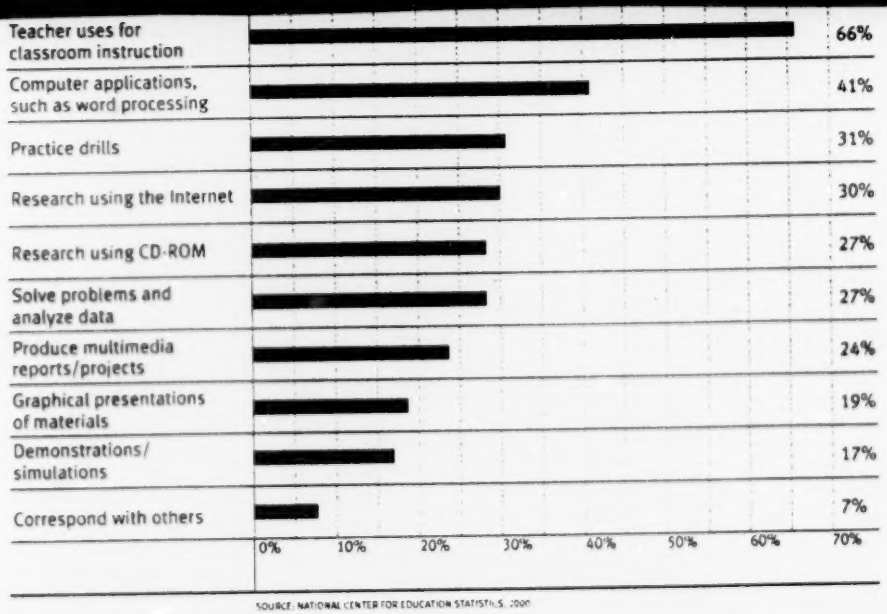
Digital content offers powerful resources and tools to teachers and students. In a digital learning environment, the dynamic nature of digital content allows students to both locate and construct information.

Share of Electronic Media Used for Instruction in U.S. Schools, 1999



SOURCE: SIMBA INFORMATION, INC., 1999

How Digital Content Is Integrated into Instruction



SOURCE: NATIONAL CENTER FOR EDUCATION STATISTICS, 2000

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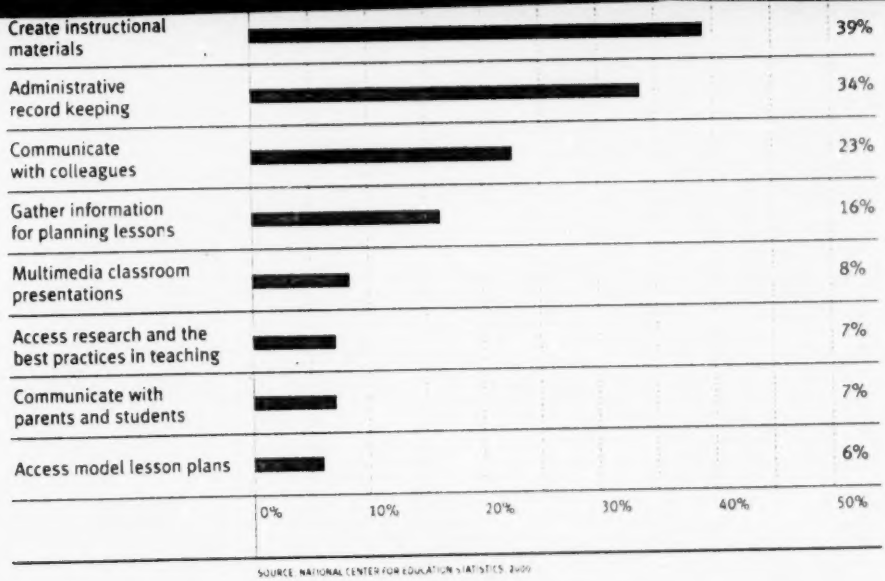
Professional Development

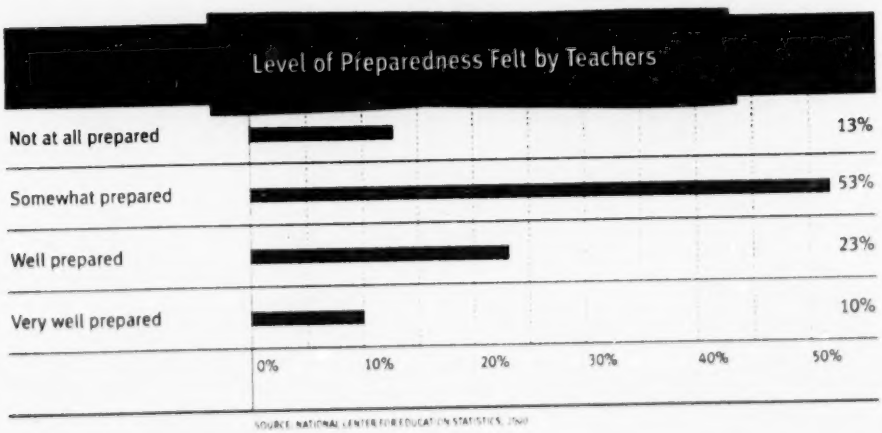
Well-trained teachers are the key to creating digital learning environments. Schools and districts must continue to make the commitment to professional development by providing the necessary support, resources and time for teachers to learn both how to use technology and, more importantly, how to integrate digital content and tools into the curriculum and instruction.

Teacher Use Of Computers or the Internet At School



SOURCE: NATIONAL CENTER FOR EDUCATION STATISTICS, 2009

Level of Preparedness Felt by Teachers



SOURCE: NATIONAL CENTER FOR EDUCATION STATISTICS, 2009

Appendix B: A Call for Equity

One of the most exciting possibilities of educational technology is the potential for widespread, equal access to ideas, information and the highest quality education. Digital learning can equalize opportunity for all students, regardless of race, ethnicity, gender, geographic location and economic status.

Conversely, the absence of technology resources has the potential to build new barriers. This lack of resources limits the possibilities for education and may perpetuate and even solidify economic disparities, class advantage and racial bias. The U.S. Department of Commerce defined this barrier as the digital divide, and has chronicled the widening gap between those who do and don't have access to technology.

While schools have made record progress establishing the necessary hardware and 95 percent of all schools are now connected to the Internet, there is a disturbing trend in classroom connectivity for the nation's poorest schools. Overall, schools reported that 63 percent of their classrooms were connected to the Internet in 1999, up from 51 percent in 1998.[v] The option for schools to use Title 1 funds and the $2.25 billion dollar per year federal E-rate program, which provides schools and libraries with discounts on Internet access and other telecommunications services, have helped connect the majority of our schools and classrooms. However, in schools reporting 71 percent or more students eligible for free or reduced-price school lunch, the classroom connection remained stagnant at 39 percent. These most disadvantaged schools often struggle against inadequate infrastructure and an insufficient electrical capacity for computers, let alone high-speed connections and networks.[vi] Since these schools cannot apply E-rate funds to fix their wiring, they are not benefiting from our national initiatives in educational technology.

Other indicators are equally alarming. Studies indicate that even when access to technology and connectivity exists, students may have unequal learning experiences. Black and Hispanic students were significantly less likely than their white counterparts to use computers for the more sophisticated simulation and application but were more likely to employ computers for drill and practice.[vii] Research also shows a disparity in use of digital content and tools. In 1997, only 17 percent of black and 20 percent of Hispanic students used a computer in school, compared to almost 40 percent of white students. And only 12 percent of Hispanic students and 15 percent of black students accessed the Internet in school, compared with 21 percent of white students.[viii]

In addition to the inequities in school, inequities continue in the home. Disparity in home computer ownership could increasingly intensify barriers in opportunity. Especially as technology fosters communication and collaboration among parents, teachers and students and anytime, anywhere learning breaks down traditional boundaries in education. Currently,

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Internet Access According to School Characteristics

School Characteristics	Percent of Public Schools with Internet Access				Percent of Classrooms with Internet Access				Students per instructional computer w/ Internet Access	
	1994	1996	1998	1999	1994	1996	1998	1999	1998	1999
All Public Schools	35%	65%	89%	95%	3%	14%	51%	63%	12	9
Instructional level										
Elementary	30%	61%	88%	94%	3%	13%	51%	62%	13	11
Secondary	49%	77%	94%	98%	4%	16%	52%	67%	10	7
Size of enrollment										
Less than 300	30%	57%	87%	96%	3%	15%	54%	71%	9	6
300 to 999	35%	66%	89%	94%	3%	13%	53%	64%	12	9
1,000 or more	58%	80%	95%	96%	3%	16%	45%	58%	13	10
Metropolitan status										
City	40%	64%	92%	93%	4%	12%	47%	52%	14	11
Urban Fringe	38%	75%	85%	96%	4%	16%	50%	67%	12	9
Town	29%	61%	90%	94%	3%	14%	55%	72%	12	8
Rural	35%	60%	92%	96%	3%	14%	57%	71%	9	7
Geographic Region										
Northeast	34%	70%	90%	94%	3%	10%	39%	56%	13	9
Southeast	29%	62%	92%	98%	2%	10%	51%	60%	12	10
Central	34%	66%	90%	93%	3%	19%	61%	70%	10	7
West	42%	62%	86%	95%	5%	15%	51%	68%	14	10
Percentage of students eligible for free or reduced price lunch										
Less than 11 percent	40%	78%	87%	94%	4%	18%	62%	74%	10	7
11 to 30 percent	39%	72%	94%	96%	4%	18%	53%	71%	11	8
31 to 49 percent	33%	62%	94%	98%	2%	12%	61%	68%	11	9
50 to 70 percent	31%	53%	88%	96%	4%	12%	40%	62%	16	10
71 percent more	19%	53%	80%	90%	2%	5%	39%	39%	17	16

SOURCE: NATIONAL CENTER FOR EDUCATION STATISTICS, 2000

47 percent of white households have computers, compared to 23 percent of black and 26 percent of Hispanic households."

With Title I and E-rate, policymakers have attempted to equalize access to technology. However, ensuring that our least affluent schools are connected is critical. Likewise, ensuring that all students benefit from skilled teachers and have adequate content to meet their educational objectives is crucial. As the nation moves forward in digital learning environments, it is imperative that technology be used to remove existing barriers and avoid creating new ones.

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Appendix C: Sites and Resources to Help Integrate Digital Content

This is a list of a few of the many resources that can help integrate high quality digital content into the curriculum. In addition, many states, districts and schools offer toolkits with links to digital content that complement state standards and requirements.

21st Century Teachers Network
www.21ct.org

The Annenberg/CPB Channel
www.learner.org/channel/about.html

AOL@School
http://school.aol.com

Apple
http://ali.apple.com
www.apple.com/education

AT&T Learning Network
www.att.com/learningnetwork/

Bell South Education Gateway
http://k12.bellsouth.net

CCCnet: Curriculum Projects Online
www.cccnet.com

Center for Teaching and Learning, National Education Association
www.nea.org

Classroom Connect
www.classroom.com/home.asp

Discovery Channel School
http://school.discovery.com

Eisenhower Clearinghouse
http://enc.org/

Federal Resources for Educational Excellence
www.ed.gov/free

IBM Lesson Plans
http://houns54.clearlake.ibm.com/solutions/education/

IkeepBookmarks.com
www.iKeepBookmarks.com/home.asp

International Society for Technology in Education
www.iste.org

The Jason Project
www.jasonproject.org

The Library of Congress
www.loc.gov

LessonPlanz.com
http://lessonplanz.com/

MCI's Marco Polo
http://www.wcom.com/marcopolo/

MSN's Schoolhouse
http://encarta.msn.com/schoolhouse/default.asp

NASA's Observatorium
http://observe.ivv.nasa.gov

National Archives and Records Administration
www.nara.gov

National Center for Research on Evaluation, Standards, and Student Testing (CRESST)
www.cse.ucla.edu

National Council for the Social Studies
www.ncss.org

National School Boards Association
http://www.nsba.org

NCREL Tools for Simulation
http://www.ncrtec.org/tools/tools.htm

NetSchools Corporation
http://www.netschools.net

PacBell's BlueWeb
http://www.kn.pacbell.com/wired/bluewebn

PBS Mathline
http://www.pbs.org/teachersource

Smithsonian Institution
www.si.edu

The State Hermitage Museum
http://www.hermitagemuseum.org

ThinkQuest
http://www.thinkquest.org

Try Science
http://www.tryscience.org

Web-based Education Commission
http://www.webcommission.org

ZapMe! Corporation
http://www.zapme.com

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Appendix D:
ISTE and SCANS Skills and Standards

ISTE Standards[39]

The International Society for Technology in Education (ISTE) has established standards for technology literate students that develop 21st Century skills.

1 Basic Operations and Concepts

- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

2 Social, Ethical, and Human Issues

- Students understand the ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

3 Technology Productivity Tools

- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

4 Technology Communications Tools

- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

5 Technology Research Tools

- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

6 Technology Problem-solving and Decision-making Tools

- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of strategies for solving problems in the real world.

www.iste.org

SCANS Competencies and Skills[40]

The United States Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) defined competencies, skills and personal qualities that should be developed by schools to ensure success in life and work for students. These are:

- **Interpersonal skills:** can work on teams, teach others, lead, negotiate, work well with people from culturally diverse backgrounds, demonstrate individual responsibility, self-esteem and self-management and integrity.
- **Information skills:** can acquire and evaluate data, organize and maintain files, interpret and communicate and use computers to process information.
- **Technology skills:** can select equipment and tools, apply technology to specific tasks, and maintain and troubleshoot using equipment.
- **Basic skills:** reading, writing, arithmetic and mathematics, speaking and listening.
- **Thinking skills:** the ability to learn, to reason, to think creatively, to make decisions and to solve problems.

http://www.ttrc.doleta.gov/SCANS/work.html

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Endnotes

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2 See www.ed.gov/Technology/potus-commit.html for a description of the Clinton Administration's Technology Literacy Challenge that outlines the four pillars of education technology.

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20 Market Data Retrieval. *Technology in Education*, 1998.

21 Ibid.

22 Education Week: *Technology Counts '99: Building the Digital Curriculum*, 1999.

23 Ibid.

24 Department of Education, National Center for Education Statistics. *Teacher Use of Computers and the Internet in Public Schools*, Stats in Brief, 2000.

25 Market Data Retrieval. *Technology in Education*, 1999.

26 For more information about Union County, Tennessee school district contact (615) 992-5466 or visit http://hpi.www.com/tnsch/d4704260.html.

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28 Ibid.

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30 Department of Education, National Center for Education Statistics. *Teacher Use of Computers and the Internet in Public Schools*, Stats in Brief, 2000. Table 2: Percent of teachers reporting using computers or the Internet for instruction and the percent assigning various uses to students to a moderate or great extent, by school and teacher characteristics: 1999

31 Ibid. Table 1: Percent of teachers indicating they use computers or the Internet "a lot" at school to accomplish various objectives, by school and teacher characteristics.

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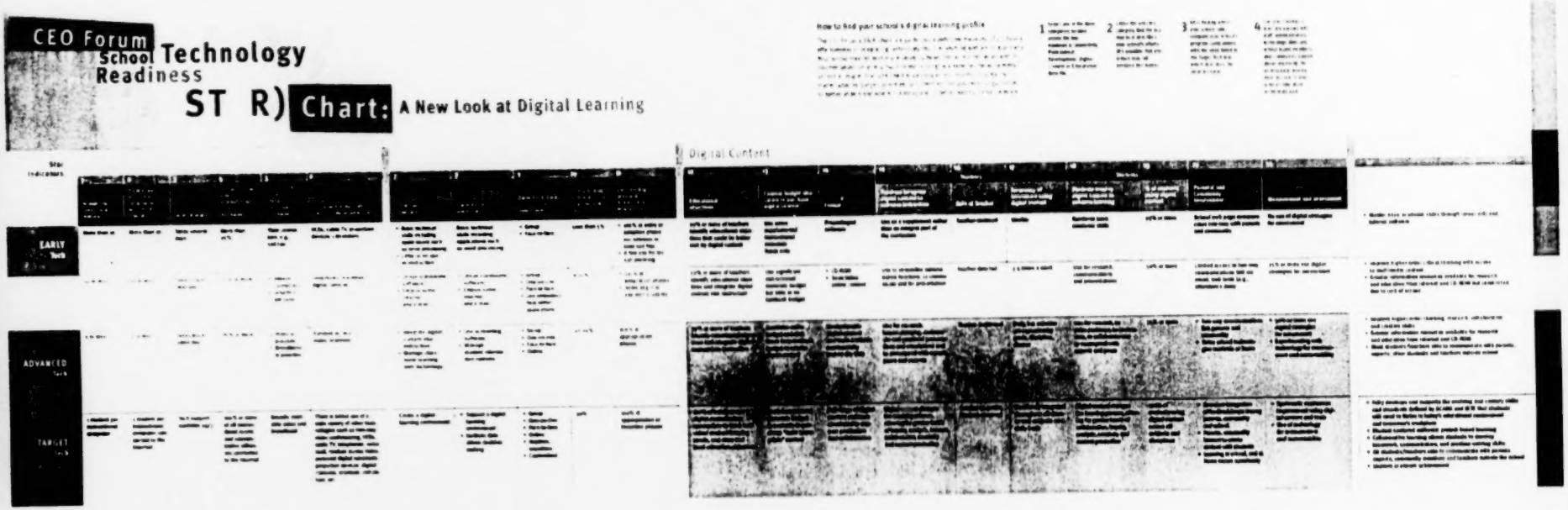

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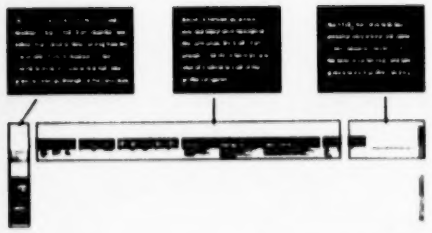

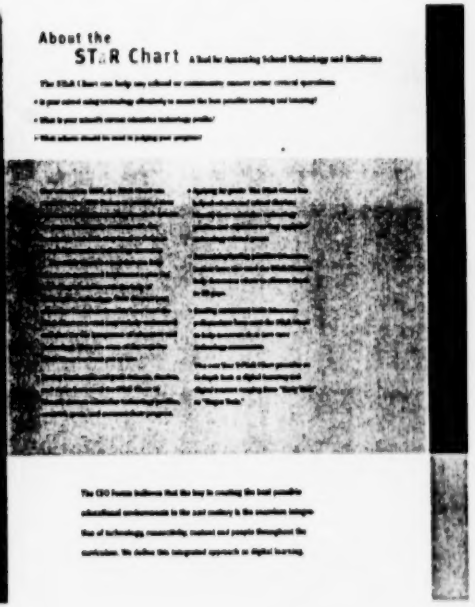

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